DESCRIPTIONS OF NEW SPECIES OF RECENT UNSTALKED CRINOIDS FROM THE NORTH PACIFIC OCEAN.

By Austin Hobart Clark,
Of the United States Bureau of Fisheries.

This paper is based upon material collected by the United States Fisheries steamer *Albatross* in the Pacific Ocean north of Mexico and southern Japan. All but two of the species were collected on the recent Japanese cruise in the Bering Sea and about Japan. The *Eschrichtii* group is best represented in regard to numbers, with over 1,750 specimens, mostly of Bering Sea and eastern Pacific forms. Unfortunately, *Antedon eschrichtii* var. *maxima* is so large (about 3 feet in diameter) that on the last cruise, although we obtained it in enormous numbers—on one or two occasions, in fact, there was very little else in the trawl—we found it impracticable to preserve an extensive series. The species of this group in the eastern Okhotsk Sea, off eastern Japan, off the Pacific-American coast, and in the Bering Sea are all remarkable for the strong overlapping of the arm joints, which have serrate distal edges, a fact which was first noticed for this district by Hartlaub in *Antedon tanneri* from Panama. The lower pinnules also have a distal comb, resembling that in some species of *Comatula*, but much longer than is usual in that genus. Another interesting fact is that the species from the western American coast all have the third syzygy in the fourteenth brachial and not in the twelfth, as do those from the Bering Sea and Asiatic coast. The distal intersyzygial interval in the North Pacific species (excepting those from southern Japan and the Japanese Sea) is almost invariably two joints, whereas in most of the others it is three. All these species will be more fully described and figured in my report on the North Pacific crinoids.

The following keys have been prepared with reference to all of the described species in the respective groups, and it is believed that the information given in them is amply sufficient to differentiate the new species from any of those given in the *Challenger* reports or subsequently described.

KEY TO THE SPECIES DESCRIBED.

Genus DECAMETROCRINUS Minckert.

A. Centro-dorsal large and conical, bearing about 80 cirri.

(1) *Decametrocrinus borealis*, new species.

Genus ANTEDON de Fréminville.

A. A syzygy in the radial axillary.

a. 10 arms: the first pinnule much elongated, with a distal comb-like process as in *Comatula*[a] .....(2) *Antedon rara*, new species.

aa. 20 arms: distichals 4 (3 + 4)[b]: cirri smooth, with 15 joints.

(3) *A. hartlaubi*, new species.

AA. Three articulated radials.

a. The lower pinnules long and flagellate, the first with very short, the second and following with much elongated joints: cirri smooth, with greatly elongated joints and a long terminal claw: brachials mostly oblong.

(4) *A. tenelloides*, new species.

aa. The lower pinnules long and flagellate, with numerous short and broad joints. [ESCHRICHTII group.]

b. Cirri always more or less spiny: distal joints of first pinnule short and broad like the basal.

c. Fifth pinnule longer than the first: first and sixth pinnules usually about equal, but the sixth may be the longer: arm joints strongly overlapping, short-triangular: intersyzygial interval two joints.

d. Third syzygy in the twelfth brachial .....(5) *A. asperrima*, new species.

dd. Third syzygy in the fourteenth brachial...(6) *A. perplexa*, new species.

cc. Fifth pinnule much shorter than the first.

d. Third pinnule the longest, with elongated joints, differing from the first and second, which have short and broad joints: fourth pinnule much shorter: 40 cirrus joints .....(7) *A. laodice*, new species.

dd. Third pinnule equal to, or not much shorter than, the second.

e. Joints of the third pinnule mostly wider than long as in the first and second: arm joints short and triangular: more than 40 cirrus joints: arms smooth: third pinnule most like the second.

(8) *A. eschrichtii* (J. Müller).

ddd. Third pinnule has fewer but much longer joints than the first and second.

e. Less than 40 cirrus joints: arm joints triangular.

f. Arm joints short, much wider than long, strongly overlapping: 35 to 40 cirrus joints .....(9) *A. inexpectata*, new species.

ee. Over 40 cirrus joints: arm joints triangular, strongly overlapping: lower brachials strongly tubercular...(10) *A. rathbuni*, new species.

dddd. Third pinnule composed of a few elongated joints, and much shorter than the second, which has short joints.

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[a] It is unfortunate that the name *Actinometra* of Johannes Müller is untenable. Müller proposed the name in 1841 (Wiegmann's Archiv für Naturgesch., 1841, Bd. I, p. 140), naming as the type *Actinometra imperialis*, which was described by him at the same time. Later, after visiting the Paris Museum, Müller found that his *Actinometra imperialis* was identical with the *Comatula solaris* of Lamarck, which is the type of the genus *Comatula* proposed by Lamarck in 1816 (Hist. Nat. des Animaux sans vertèbres, II, p. 530.). Thus *Comatula* 1816 and *Actinometra* 1841, being founded on the same species, are synonyms, and it becomes necessary to replace the latter by the older name established by Lamarck.

[b] 4 (3+4): four joints, the third and fourth united by syzygy.

e. Middle and distal arm joints very short, much wider than long.
f. Calyx and arm bases smooth: third syzygy in the twelfth brachial.
g. Distal arm joints with smooth edges, not overlapping: intersyzygial interval 1 to 5, usually 3 joints..(11) *A. brachymera*, new species.
gg. Distal arm joints strongly overlapping, with serrate edges: intersyzygial interval 2 joints.....(9) *A. inexpectata*, new species.
ff. Calyx and arm bases spinous: third syzygy in the fourteenth brachial.....(12) *A. serratissima*, new species.
ddddd. The third pinnule, while much shorter than the second, has similar joints, which are more elongate than those of the first.
e. 60 cirrus joints: first pinnule the longest: radials and lower brachials with raised and spiny edges.....(13) *A. maria*, new species.
ee. 35 to 40 cirrus joints: radials and lower brachials smooth.
(14) *A. hondoensis*, new species.
bb. Cirri perfectly smooth: distal joints of first pinnule somewhat elongate.
(15) *A. clio*, new species.
aaa. Lower pinnules long and flagellate, with elongated joints...[TENELLA group.]
b. Cirri with more than 30 joints: centrodorsal long and conical with 5 interradial ridges, each inclosing 3 rows of cirrus sockets.
c. First pinnule much longer than the second..(16) *A. erythrizon*, new species.
cc. Second pinnule as long as the first.....(17) *A. fragilis*, new species.
bb. Cirri with about 20 joints.
c. First pinnule twice as long as the second.....(18) *A. tenuis*, new species.
cc. Second pinnule nearly as long as the first.
d. Middle arm joints triangular: syzygial interval 2 or 3 joints.
e. Cirrus joints long: lower pinnules not carinate.
(19) *A. ciliata*, new species.
ee. Cirrus joints short: lower pinnules strongly carinate.
(21) *A. arctica*, new species.
dd. Middle arm joints quadrate and elongated: syzygial interval 1, sometimes 2 joints.....(20) *A. isis*, new species.
bbb. Cirri with less than 15 joints.
c. Cirri smooth, with elongated joints: radials and lower brachials in contact and tubercular: first two pinnules short.....(22) *A. briseis*, new species.

1. DECAMETROCRINUS BOREALIS, new species.

Centro-dorsal conical, 9 mm. in diameter, and comparatively high, bearing about 80 cirri, the dorsal pole free. Cirri lacking.

First radials just visible; first brachial short, about three times as wide as high, somewhat incised by the second; second brachial irregularly quadrate, about as long as wide, with a backward projection, rising into a tubercle; following brachials quadrate, becoming triangular after the basal third of the arm, then quadrate again toward the end and elongate at the tip. Syzygies in the fourth brachials, again about the eighth or ninth, and distally at intervals of from 2 to 6 (usually about 3 or 4) joints. Arms 125 mm. in length, with about 100 joints.

First pinnule, on the second brachial, 15 mm. long, slender, with 45 or 50 short joints. Second pinnule, on third brachial, 12 mm. long, resembling the first; third pinnule like the second; distal pinnules 15 mm. long, with about 20 long, slender joints.

The color in life is purplish brown, the skeleton nearly white; the disk is black.

Type.—Cat. No. 22652, U.S.N.M., from *Albatross* station No. 4918; 30° 22′ 00″ north latitude, 129° 08′ 30″ east longitude (Eastern Sea); 361 fathoms; August 13, 1906.

2. ANTEDON RARA, new species.

Centro-dorsal large and discoidal, bearing about 20 cirri. These are 5 mm. long, with 8 or 10 joints, the basal half greatly elongated, centrally constricted, the distal short and compressed.

Second radials barely visible; axillaries pentagonal, wider than high, with a syzygy; 10 arms 35 mm. long, the first 3 brachials oblong, the remainder quadrate (the fifth to the ninth almost triangular) becoming elongate distally. A syzygy in the third brachial, another about the tenth, and others distally at intervals of about 2 joints.

First two (outer) pinnules the longest, with about 20 short joints, bearing a comb distally, as in *Comatula*. The third to the sixth pinnules are shorter, without combs, and bear much swollen rounded genital glands on the second and third joints; distally the pinnules are longer and more slender. Disk that of a typical *Antedon*.

The color in life is light clear yellow, the cirri white.

Type.—Cat. No. 22605, U.S.N.M., from *Albatross* station No. 4892; 32° 27′ 30″ north latitude, 128° 33′ 00″ east longitude (Eastern Sea); 181 fathoms; August 9, 1906.

3. ANTEDON HARTLAUBI,[a] new species.

Centro-dorsal a thick disk, the pole beset with small spines, bearing about 30 marginal cirri; these are smooth, without dorsal spines, 20 mm. long, with 15 remarkably uniform joints, all of which are somewhat longer than wide. There is no opposing spine to the terminal claw.

Radials concealed as far as the syzygy in the axillary; axillaries low and wide; distichals 4, the two outer united by syzygy; rarely 3, the two outer united by syzygy; 20 arms 120 mm. long, the first eight brachials oblong, the remainder triangular, somewhat wider than high, becoming quadrate at the tips of the arms; a syzygy in the third brachial, another about the fifteenth, and others distally at intervals of from 4 to 7 joints.

First pinnule on the second distichal, always on the outer side of the rays, 4 mm. long, with about 20 joints, the first three or four broad, with rough dorsal projections, the distal short but slender; the second brachial bears a slender pinnule 11 mm. long with about 40 short joints, the first two with dorsal processes. From the first two brachial pinnules,

[a] For Dr. Clemens Hartlaub, in recognition of his work on the unstalked crinoids of the Indian Archipelago.

the pinnules gradually decrease in size, increasing again and becoming very slender distally.

Color in life yellowish brown, the skeleton whitish.

Type.—Cat. No. 22606, U.S.N.M., from *Albatross* station No. 4934; 30° 58′ 30″ north latitude, 130° 32′ 00″ east longitude (off Kagoshima Gulf); 152–103 fathoms; August 16, 1906.

4. ANTEDON TENELLOIDES, new species.

Centro-dorsal a thick disk, bearing about 60 or 70 slender marginal cirri; these are 35 mm. long, with fifteen to seventeen greatly elongated joints, perfectly smooth, the cirrus ending in a long sharp terminal spine.

Second radial partially visible, the centro-dorsal usually extending up to the inferior end of the axillary; the axillary is wider than high; 10 arms 110 mm. long, with about 120 brachials, usually regularly oblong throughout the arm, proportionately longer distally. Syzygies in the third, eighth, and twelfth brachials, and distally at intervals of 2 joints.

First pinnule 14 mm. long, slender, composed of 35 to 40 short joints, all of which are wider than long; second pinnule 10 mm. long, with 20 joints, all but the basal 3 or 4 much longer than wide; third pinnule 8 mm. long, with 15 joints, the basal 4 squarish, the rest longer than wide, with a large genital gland on the fourth to the eighth; following pinnules to the thirteenth essentially like the third; distal pinnules 20 mm. long, very slender, with 25 to 30 elongated joints.

Color in life grayish brown, dorsal surface and cirri nearly white.

Type.—Cat. No. 22607, U.S.N.M.; from *Albatross* station No. 5092; 35° 04′ 50″ north latitude, 139° 38′ 18″ east longitude (Uraga Straits, entrance to Tokyo Gulf); 70 fathoms; October 26, 1906.

5. ANTEDON ASPERRIMA, new species.

Centro-dorsal hemispherical, 9 mm. in diameter, bearing 30–70 (usually 50–60) cirri, the upper 50–53 mm. long with 50–60 joints short and squarish at the base, becoming about twice as long as wide, then gradually becoming square or even wider than long toward the tip; the lower 25 mm. long with 25–30 joints, not much longer than wide, and stout in proportion to their length, being as thick as, or even thicker than, the more elongate cirri of the upper row. The cirri are not always dimorphic in this species; frequently they are all of one type.

First radials almost concealed by the centro-dorsal; second radials very short and trapezoidal, about four times as wide as long; axillaries about as wide as high, equal in width to the horizontal diameter of the second brachials, with a sharp distal angle; 10 arms about 230 mm. in length,

with 250–300 joints, the edges of all raised distally and overlapping the succeeding joint, this character becoming marked after the eighth brachial. The distal edges of the joints are set with a row of fine sharp teeth, each with a median ridge which is continued in a raised line for some distance back onto the joint, giving it a longitudinally striate appearance. All the syzygies except the proximal two or three are supplied with a row of these teeth, becoming distally quite as prominent as those on the articulations. The first brachial is trapezoidal in shape, the outer edge being about twice as long as the inner; the second brachial is triangular when viewed externally; the succeeding joints to the tenth are quadrate, having pinnules on their shorter sides, and their apposed edges rising to tubercular prominences, alternating in position; from the tenth on the brachials are triangular, rather short, and becoming shorter distally. Syzygies always in the third, eighth, and twelfth brachials, and distally at intervals of 2 joints.

The first pinnule is 20 mm. long with nearly 100 very short joints; the second pinnule is 24 mm. long, both this and the first with a strong comb on their distal half; the third pinnule is 25 mm. long, with much more elongate joints and only the last quarter with a comb; the fourth pinnule is 24 mm. long, the fifth 23 mm. long, and the sixth 20 mm. long, all with much elongated joints; the fourth and following pinnules bear genital glands; distally the length decreases to about the twelfth pinnule, then increases again.

This species is readily distinguished by the great length of all the pinnules, and especially of the first six or eight pairs, which are remarkably uniform, combined with the presence of a syzygy in the twelfth brachial.

Color in life yellow, the cirri whitish.

Type.—Cat. No. 22650, U.S.N.M.; from *Albatross* station No. 3332; 54° 02′ 50″ north latitude, 166° 45′ 00″ west longitude (Bering Sea); 406 fathoms; August 21, 1890.

6. ANTEDON PERPLEXA, new species.

In general similar to the preceding species, but more slender, the arm joints more elongate and quadrate, the axillary considerably wider than the second radial, and the third syzygy almost invariably in the fourteenth brachial, rarely in the thirteenth, and never in the twelfth.

Color in life yellow or brownish yellow, the cirri whitish.

Type.—Cat. No. 22611, U.S.N.M.; from *Albatross* station No. 3070; 47° 29′ 30″ north latitude, 125° 43′ 00″ west longitude (off the coast of Washington); 636 fathoms; June 28, 1889.

7. ANTEDON LAODICE, new species.

Centro-dorsal low, hemispherical, bearing about 40 cirri; these are 40 mm. long, with 40 joints, the basal half of which are longer than wide, the distal short and furnished with low spines.

First radials partially visible; second radials short, oblong, incised by a backward projection of the axillary; axillaries about as wide as high, with a backward projection forming a tubercle; 10 arms; first brachial irregularly quadrate, with a short inner and long outer border; second brachial almost triangular; following brachials quadrate, becoming triangular after the fourteenth or fifteenth; syzygies in the third, eighth, and twelfth or thirteenth brachials, and distally at intervals of 3 joints.

Two first pinnules 20 mm. long, slender and flagellate, with 50 very short joints; third pinnule 22 mm. long with 46 joints; the fourth shorter; fifth and sixth much shorter, with the joints more elongate. The first 4 pinnules bear combs.

Color in life lemon yellow, the cirri lighter.

Type.—Cat. No. 22609, U.S.N.M.; from *Albatross* station No. 4969; 33° 23′ 40″ north latitude, 135° 33′ 00″ east longitude (off southern Japan); 587 fathoms; August 29, 1906.

8. ANTEDON ESCHRICHTII (J. Müller.)

The specimens of this species obtained in the Okhotsk Sea and the Sea of Japan appear to be structurally identical with others from Europe and the Atlantic coast of America, but the size is much greater, the extent reaching 700 mm. and the cirri 115 mm., as against a maximum of 500 mm. and 70 mm., as given by Dr. P. Herbert Carpenter in the *Challenger*[a] report. *Antedon eschrichtii* in the Pacific has a remarkably restricted range, being found only in the Sea of Okhotsk, about southern Sakhalin and La Perouse straits, in parts of the Gulf of Tartary, and in the northern part of the Sea of Japan. On the southern and eastern shores of Japan, along the Kurils and in the Bering Sea it is replaced by quite different species. Considering the isolated and circumscribed habitat of this species in this region, together with its uniformly greater size, it seems best to bestow upon it, for the present at least, the varietal name of *Antedon eschrichtii maxima*, taking as the type-locality 43° 01′ 35″ north latitude, 140° 10′ 40″ east longitude, in 248 fathoms, off the coast of Hokkaido, in the Sea of Japan.

9. ANTEDON INEXPECTATA, new species.

This species resembles *Antedon asperrima* and *A. perplexa* in general appearance, but the third pinnule is distinctly smaller than the first and second (which are about equal in size), frequently very much

[a] *Challenger* Reports, Report on the Crinoidea, Zoölogy, XXVI, p. 139.

so; the fourth pinnule is still smaller, the minimum being reached on the seventh or eighth, after which the length increases distally. *Antedon inexpectata* is a somewhat stouter species than *A. asperrima*, and is usually smaller, although some individuals are fully as large as my largest of that species, measuring, arms 230 mm., cirri 70 mm. The third syzygy is in the twelfth brachial.

The color in spirits is brownish yellow.

Type.—Cat. No. 22647, U.S.N.M.; from *Albatross* station No. 2853; 56° 00′ 00″ north latitude, 154° 20′ 00″ west longitude (south of Alaska Peninsula); 159 fathoms; August 9, 1888.

10. ANTEDON RATHBUNI,[a] new species.

This species resembles *Antedon asperrima*, but is very much more robust, with the lower arm joints strongly tubercular; the first three pinnules are of equal length, the fourth somewhat, and the fifth much shorter, little over half as long as the third. The arrangement of the syzygies is as in *A. asperrima*.

The color in life is bright yellow.

Type.—Cat. No. 22648, U.S.N.M.; from *Albatross* station No. 5033; 44° 04′ 20″ north latitude, 145° 28′ 00″ east longitude (in Yezo Straits); 533 fathoms; September 30, 1906.

11. ANTEDON BRACHYMERA, new species.

Centro-dorsal hemispherical, bearing 30 to 50 cirri; these are 45 mm. or 50 mm. long, with 40 to 45 joints of which the distal third bear low dorsal spines.

First radials just visible; second radials short, trapezoidal, much wider than high; 10 arms 160 mm. long; first 14 or 15 brachials smooth, slightly tubercular, wider than long, irregularly oblong or somewhat quadrate; following brachials low-quadrate, becoming shorter distally, the distal edges produced outward, but smooth and not overlapping; none of the brachials are triangular, and all are wider than long, the middle and distal very much so; syzygies in the third and eighth, usually also in the twelfth brachials, and distally at intervals of from one to five, usually three joints.

First pinnule 30 mm. long with 65 to 70 short and wide joints, the distal third with a comb; second pinnule the same length or very slightly shorter, similar to the first, but with the comb not so pronounced; third pinnule like the fourth, 16 mm. long with 28 joints, mostly rather longer than wide; the following pinnules decrease in length to about the tenth, then increase again distally.

Color in life yellowish white, readily distinguishable from the lemon yellow *Antedon eschrichtii maxima*, with which it is always associated.

[a] For Dr. Richard Rathbun, in recognition of his work on the Crinoidea.

Type.—Cat. No. 22649, U.S.N.M.; from *Albatross* station No. 4986; 43° 01′ 40″ north latitude, 140° 22′ 40″ east longitude (Sea of Japan); 172 fathoms; September 19, 1906.

12. ANTEDON SERRATISSIMA, new species.

Centro-dorsal hemispherical, with 40 or 50 stout cirri, almost all the joints of which bear strong dorsal spines; the cirri are 30 mm. long, with about 36 joints, which exhibit a tendency to overlap.

First radials concealed; second barely visible; axillaries very broad; 10 arms 105 mm. in length; first brachials very short; second triangular, approximally equilateral; third irregularly oblong; following brachials to the tenth or twelfth, wedge-shaped, then triangular. Syzygies in the third, eighth, and fourteenth brachials, and distally at intervals of 2 joints. The radials and lower brachials are thickly set with small sharp spines. Brachials overlapping, the edges of all set with numerous small sharp teeth.

The first pinnule is 17–21 mm. long with 45–60 short joints, and bears a long comb distally; the second pinnule (which is longer than the first) is from 18–22 mm. in length, with 45–60 joints; the third pinnule may be 20 mm. long with 36 joints and bearing a comb like the second, or it may be 12 mm. long with elongated joints, like the fourth; the distal pinnules are long and slender, their joints overlapping, the distal edges set with spines.

Color in life yellow, the cirri whitish; in spirits white, brown, or red.

Type.—Cat. No. 22612, U.S.N.M.; from *Albatross* station No. 3464; 48° 14′ 00″ north latitude, 123° 20′ 40″ west longitude (off the coast of Washington); 40 fathoms; September 4, 1891; 32 other specimens from the coast of Washington, Oregon, and northern California.

This is a much stouter species than *Antedon perplexa*, with proportionately shorter arms. It is readily distinguishable from that form by the spiny character of the radials, lower brachials, and pinnules, and the proportionately greater size of the centro-dorsal, which entirely conceals the first and almost entirely the second radials.

13. ANTEDON MARIÆ,[a] new species.

Centro-dorsal hemispherical, bearing about 50 cirri (the pole free) dimorphic in character; the upper (about the edge of the centro-dorsal) 60 mm. in length, with 60 joints, compressed laterally, elongate proximally, short distally, the distal joints with faintly indicated spines; the lower 35 mm. in length with about 30 joints.

First radials concealed except for a narrow border; second radials short, about four times as wide as long; axillaries about as high or

[a] For Mrs. Mary W. Clark, of Boston, Massachusetts, to whom I am indebted for much valuable assistance in my work on the unstalked crinoids.

higher than wide, triangular, the middle of the proximal border raised into a slight tubercle, the inferior edge set with fine teeth. Ten arms; the first brachial with short inner and long outer edge, the latter with a row of small sharp spines; second brachial irregularly quadrate; third brachial with a longer inner than outer edge; following brachials to the eleventh oblong, the next few quadrate, then triangular.

First pinnule 22 mm. in length, slender and flagellate, with 60 short joints, wider than long, of which the terminal 25 or 30 bear a comb; second pinnule 19 mm. long with about 40 joints, longer in proportion than those of the first; third pinnule 16 mm. long, with 40 joints, and, like the second, with a terminal comb. Following pinnules much shorter, with fewer and longer joints and no comb; the pinnule on the twenty-sixth brachial is 12 mm. long, slender, with 20 elongated joints.

Color in life clear yellow, cirri lighter.

Type.—Cat. No. 22608, U.S.N.M.; from *Albatross* station No. 5092; 35° 04′ 50″ north latitude, 139° 38′ 18″ east longitude (Uraga Straits, entrance to Tokyo Gulf); 70 fathoms; October 26, 1906.

14. ANTEDON HONDOENSIS, new species.

Centro-dorsal hemispherical, bearing 30 to 50 cirri, the pole bare; cirri 40 mm. long, with 35 to 40 joints, the distal half spiny, the articulations rather prominent.

First radials just visible; second radials very short; axillaries somewhat wider than high, with an open distal angle; ten arms 140 mm. long; first brachial very short, the next triangular; following brachials to about the tenth irregularly oblong, almost squarish, then becoming quadrate as long as or longer than wide, the proportion remaining about the same to the end of the arm.

First two pinnules 24 mm. long, with short and broad joints, becoming squarish after the first five or six; the basal five or six joints bear high but short dentate dorsal processes, those on the different joints separated from each other by deep notches; third pinnule 14 mm. long, with rather elongated joints, resembling those of the second. The fifth pinnule bears a small genital gland, which increases in size on the sixth and following. The distal pinnules are long and slender, with the edges of the joints set with small spines.

This species is peculiar in having the position of the third syzygy quite irregular, but usually on the twelfth, thirteenth, or fourteenth brachials; the distal intersyzygial interval is two joints.

Type.—Cat. No. 22651, U.S.N.M.; from *Albatross* station No. 5048; 38° 09′ 24″ north latitude, 141° 52′ 30″ east longitude (off Kinka San Light, east coast of Nipon); 129 fathoms; October 10, 1906.

15. ANTEDON CLIO, new species.

Centro-dorsal hemispherical, bearing 40–50 cirri, a large polar area free; cirri 17 mm. long, slender, with 25–30 joints, of which the fourth to fifteenth are much longer than wide, then decreasing in length, becoming squarish distally; the distal joints do not bear dorsal spines.

First radials visible at angles of calyx, laterally separated distally; second radials very short, widely separated laterally, very deeply incised by the rhombic axillaries; axillaries rhombic, or possibly slightly longer than wide, the distal angle somewhat open. Ten arms, 55 mm. long; first brachial very short and deeply incised, the inner edge much shorter than the outer; second brachial irregularly quadrate, produced distally on the outer side of the ray, and proximally in the median line; third brachial quadrate, the inner side more than twice the length of the outer, the epizygal quadrate with the inner side longer than the outer, the hypozygal triangular, with the short side in the inner side of the ray, the apex on the outer; next five brachials irregularly oblong, then quadrate for five or six, then triangular, about as wide as high, becoming quadrate again distally; syzygies in the third, eighth, and twelfth brachials, and distally at intervals of three joints; the lower brachials are raised distally, giving the lower part of the arms a distinctly serrate appearance; the edges of the outer brachials are slightly roughened, but do not overlap.

First pinnule 10 mm. long, very slender, with about 30 joints, the basal 6 or 7 of which are short and wide, then becoming more elongate, but never much more than twice as long as wide; second pinnule much shorter (7 mm.) and stouter, with 15 joints, the first 3 short, the remainder greatly elongated; the following pinnules are stouter, but in general similar to the second; they gradually decrease in length to about the seventh, then become more slender and increase in length distally where they are 8 mm. long with about 20 slender joints, all but the basal two, which are short, greatly elongated.

Color in life light yellow, banded with white, the cirri white, with occasional narrow bands of yellow.

Type.—Cat. No. 22618 U.S.N.M.; from *Albatross* station No. 4904; 32° 31′ 20″ north latitude, 128° 32′ 40″ east longitude (Eastern Sea); 107 fathoms; August 10, 1906.

16. ANTEDON ERYTHRIZON, new species.

Centro-dorsal long and conical, divided by 5 interradial ridges into areas containing 3 parallel rows of cirri, about 12 in each area, or 60 in all. The cirri are about 50 mm. long, with 35–40 elongated, much compressed, smooth joints, the longest between 3 and 4 times as long as wide, decreasing in length distally; terminal spines very small.

First radials visible at angles of calyx; second radials crescentic, deeply incised to receive the strong backward projection of the axillaries; axillaries quadrate in form, about as long as wide, all the sides somewhat concave; 10 arms; the first brachials have long outer and short inner sides, and are very deeply incised by the second brachials, which are nearly square; the six following brachials are oblong, subsequently becoming quadrate for a few joints, then triangular; a syzygy in the third brachial, another about the eighth, and others distally at intervals of from 5–10 joints.

The first pinnule is about 20 mm. long and very slender, composed of 16 greatly elongated joints; the second pinnule is 15 mm. long with about 12 elongated joints; the following pinnules decrease in length, their component joints being much shorter proportionately: the distal pinnules are 17 mm. long with about 17 greatly elongated joints.

Color in life, dull purple, rather dark.

Type.—Cat. No. 22613 U.S.N.M.; from *Albatross* station No. 4981; 42° 58′ 15″ north latitude, 140° 09′ 10″ east longitude (Sea of Japan); 406–390 fathoms; September 19, 1906.

17. ANTEDON FRAGILIS, new species.

This species is similar to *A. erythrizon* in the character of its centrodorsal and in its general appearance; but the cirri consist of about 30 greatly elongated smooth joints; the first two pinnules are equal in length, comparatively short (14 mm.) but slender, with about 20 elongated joints, the third longer and distinctly stouter; the axillaries and lower brachials are more elongated than in *A. erythrizon;* syzygial interval 2, sometimes 3, joints.

Color in life, light purplish brown.

Type.—Cat. No. 22614, U.S.N.M.; from *Albatross* station No. 5032; 44° 05′ 00″ north latitude, 145° 30′ 00″ east longitude (Yezo Straits); 500 fathoms; September 30, 1906.

18. ANTEDON TENUIS, new species.

(?) *Antedon* species, VON GRAFF *Challenger* Reports 1884, vol. X of Zoology, No. 27, p. 79 (Vladivostok).

Centro-dorsal flattened hemispherical, bearing about 40–50 cirri, the pole free; the cirri are 25 mm. long and have about 20 elongated joints, becoming shorter distally and developing a low dorsal spine.

First radials concealed; second radials short and deeply incised by the axillaries; axillaries slightly wider than high, rhombic, the edges slightly concave; the axillaries are wider than the second radials; 10 arms, 110 mm. long and very slender; first brachial very short, the outer edge longer than the inner; second irregularly quadrate; following brachials to the eighth squarish, then quadrate to somewhat past the middle of the arm, after which they become long and "dicebox

shaped;" syzygies in the third, eighth, and twelfth brachials, and distally in alternate joints.

First pinnule 20 mm. long, very slender, with 30 joints, the basal 5 wider than long, then becoming slender and greatly elongated; second pinnule about half as long as the first, with about 20 joints, the basal two or three wider than long, the rest elongated, a large genital gland on the fifth to eleventh joints; third and following pinnules like the second; distal pinnules 13 mm. long with 25 very slender joints, the two basal short and somewhat flattened.

Color in life, light yellow-brown.

Type.—Cat. No. 22615, U.S.N.M.; from *Albatross* station No. 4997; 47° 38′ 40″ north latitude, 141° 24′ 30″ east longitude (Gulf of Tartary); 318 fathoms; September 23, 1906.

19. ANTEDON CILIATA, new species.

Centro-dorsal low hemispherical, the pole bare, with 40–50 cirri, the longest (about the margin) reaching 35 mm. in length, and consisting of about 20 (usually rather less) elongated joints, all of which are longer than wide, the basal half very much so; apical cirri much shorter and more slender, but with the same number of joints.

First radials concealed; second radials short and wide, more or less incised by the axillaries; axillaries rhombic in form, wider than high, with the sides slightly concave, and considerably wider than the second radials; 10 arms 130 mm. in length; the first brachial irregularly quadrate, with a long outer and short inner edge; second brachial irregularly quadrate, with a long outer and short inner edge; third brachial squarish; following brachials to the tenth irregularly oblong with the borders somewhat, often strongly, tubercular; succeeding brachials triangular, about as wide as high, becoming quadrate distally; syzygies in the third, eighth, and twelfth brachials, and distally at intervals of 2, sometimes 3, joints.

First pinnule 20 mm. long, with 35 joints, the proximal 12 short and wide, mostly wider than long, the distal 23 extremely long and slender; second pinnule somewhat less, with 20 joints, the 2 basal wider than long, the basal 10 carinate, the distal 10 much elongated and slender, and a large genital gland occupying the third to eleventh; following pinnules like the second; distal pinnules long and very slender, with 30 joints, the first two short and wide, the others greatly elongated, especially distally.

Color in life, light purplish brown, the skeleton lighter; cirri nearly white.

Type.—Cat. No. 22616, U.S.N.M.; from *Albatross* station No. 4982; 43° 00′ 00″ north latitude, 140° 10′ 30″ east longitude (Sea of Japan); 390–428 fathoms; September 19, 1906.

20. ANTEDON ISIS, new species.

Centro-dorsal hemispherical, bearing 30–40 slender cirri, 10 mm. long, with 20 joints, not especially elongate, the fourth, which is the longest, being little more than twice as long as high; all the joints are expanded distally, slightly overlapping, but do not develop dorsal spines.

First radials visible at angles of calyx; second radials narrow and much curved; axillaries approximately square, with the sides concave. Ten arms 65 mm. long, very slender; first brachial short, with a long outer and short inner edge; second brachial irregularly quadrate; third and following brachials irregularly quadrate, becoming longer later, and very long and "dice-box" shaped distally; syzygies in the third, eighth, and twelfth brachials and distally in alternate joints, sometimes with intervals of 2 joints.

First pinnule 7 mm. long, moderately slender, with about 20 joints, the basal 3 or 4 short, the others longer than wide; the second pinnule somewhat shorter, with about 12 joints, the basal 4 short, the rest longer than wide; third pinnule like the second and of the same length; the fourth and following pinnules bear large genital glands; distal pinnules 9 mm. long, very slender, with 15 joints, the first 2 short and expanded, the remainder much elongated.

Color in life yellowish brown, the skeleton and cirri lighter.

Type.—Cat. No. 22617, U.S.N.M.; from *Albatross* station No. 4917; 30° 24′ 00″ north latitude, 129° 06′ 00″ east longitude (about 90 miles WSW. of Kagoshima Gulf); 361 fathoms; August 13, 1906.

21. ANTEDON ARCTICA, new species.

Centro-dorsal small, hemispherical, bearing about 30 cirri; these are 13 mm. long, with 20 to 25 joints, the longest about twice as long as broad, becoming short and squarish in the distal half; distal 6 or 7 joints may or may not have blunt dorsal spines.

First radials just visible; second radials very short, trapezoidal, more or less incised by the axillary; axillary nearly twice as wide as high. Ten arms, the first 9 brachials squarish, then quadrate, longer than wide, becoming more elongate distally; syzygies usually in the third, eighth, and twelfth (sometimes seventh and eleventh or thirteenth) brachials, and distally at intervals of two joints. The arms are 25 mm. long to the twenty-fifth brachial.

First two pinnules very long (8 mm.) about equal in length, flagellate, the first with 25 joints, less than twice as long as broad, serrate at the tip, the basal 6 or 7 joints strongly carinate; second pinnule with rather fewer, more elongate joints, also carinate basally, but not so much so as the first; third pinnule much shorter, stouter, with elongate

cylindrical joints, not carinate basally; the following pinnules gradually become more slender and elongated.

Color (in spirits) rather dark brown.

Type.—Cat. No. 22610, U.S.N.M.; Camp Clay, Cape Sabine, arctic coast of Alaska; received from Lieut. (now Maj. Gen.) A. W. Greeley, U. S. Army, in 1886.

This species is interesting in belonging to quite a different type of the *Tenella* group from those heretofore known as inhabitants of the Arctic seas, which agree in having from half again as many to twice as many cirrus joints as *A. arctica*, and the second pinnule usually much smaller than the first, whereas in *A. arctica* the second pinnule is as long as or even a trifle longer than the first. *A. arctica* represents a group of species occurring in the southern seas from 46° south latitude north to about the equator; and this fact is of especial interest in that the Bering Sea and north Pacific (exclusive of the Okhotsk Sea and Sea of Japan) species of the *Eschrichtii* group are also more nearly related to the antarctic than to the arctic species.

22. ANTEDON BRISEIS, new species.

Centro-dorsal discoidal or low hemispherical, the pole papillose, bearing about 20 cirri in 2 or 3 irregular marginal rows; cirri 8 mm. long with 12 to 14 joints, all longer than wide, the second to the seventh greatly elongated; the joints are somewhat constricted in the middle, with prominent articulations, and do not bear dorsal spines.

First radials just visible; second radials very short, about four times as wide as long, somewhat incised by the axillary; they have strong rounded median keels, posterior lateral tubercles on each side, and a dorso-ventral ridge in the anterior portion; axillaries rhombic, about as wide as high, all the sides, especially the two posterior, much incurved, with a strong posterior median tubercle, which is continued backward over the second radial. Ten arms 23 mm. long; the first brachial has a short inner and long outer edge, and is deeply incised by the backward projection of the second brachial; second brachial irregular in shape, the inner edge very short, the outer long, the two proximal edges much incurved; there is a large tubercle on its posterior border, overlapping the first brachial; third brachial squarish; following brachials quadrate, at first wider than long, but becoming longer than wide after the tenth, and elongate distally; syzygies in the third, eighth, and twelfth brachials and distally at intervals of two joints.

First pinnule 2.5 mm. long with 7 joints, all but the first 2, which are squarish, greatly elongated; second pinnule similar, but apparently very slightly shorter; the distal pinnules are 4 mm. long, exceedingly slender, with about 15 joints, all but the first 2, which are very

short, greatly elongated. The radials and first brachials are in close apposition laterally, and are somewhat flattened.

Color in life light yellowish brown with broad bands of darker yellow brown on the arms.

Type.—Cat. No. 22658, U.S.N.M.; from *Albatross* station No. 4876; Sea of Japan.

This species is nearest to *A. nana* Hartlaub (=*A. macropygus* Lütken MS) from Amboina and the Tonga Islands, from which it differs in having the cirri smooth, the radials and lower brachials carinate and tubercular, and the brachials elongate.